Part of #14/13

SEQUENCE LISTING

<110> Miller, Brian S.
      Shetty, Jayarama K.

<120> Modified Forms of Pullulanase

<130> GC396-2

<140> 09/262,126
<141> 1999-03-03
<160> 9

<170> FastSEQ for Windows Version 3.0

<210> 1
<211> 2794
<212> DNA
<213> Bacillus deramificans

<220>
<221> misc_feature
<222> (1)...(2794)
<223> n = A, T, C, or G

<400> 1

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gctgactctt ttggagctgt tgcaagtgct gatattccag gaaacccaag tcaggtagga     180
attatcgttc gcactcaaga ttggaccaaa gatgtgagcg ctgaccgcta catagattta     240
agcaaaggaa atgaggtgtg gcttgtagaa ggaaacagcc aaattttta taatgaaaaa      300
gatgctgagg atgcagctaa acccgctgta agcaacgctt atttagatgc ttcaaaccag     360
gtgctggtta aacttagcca gccgttaact cttggggaag gnnnaagcgg ctttacggtt     420
catgacgaca cagcaaataa ggatattcca gtgacatctg tgaaggatgc aagtcttggt     480
caagatgtaa ccgctgtttt ggcaggtacc ttccaacata tttttggagg ttccgattgg     540
gcacctgata atcacagtac tttattaaaa aaggtgacta caatctcta tcaattctca      600
ggagatcttc ctgaaggaaa ctaccaatat aaagtggctt taaatgatag ctggaataat     660
ccgagttacc catctgacaa cattaatttta acagtccctg ccggcggtgc acacgtcact     720
ttttcgtata ttccgtccac tcatgcagtc tatgacacaa ttaataatcc taatgcggat     780
ttacaagtag aaagcggggt taaaacggat ctcgtgacgg ttactctagg ggaagatcca     840
gatgtgagcc atactctgtc cattcaaaca gatggctatc aggcaaagca ggtgatacct     900
cgtaatgtgc ttaattcatc acagtactac tattcaggag atgatcttgg gaatacctat     960
acacagaaag caacaacctt taaagtctgg gcaccaactt ctactcaagt aaatgttctt    1020
ctttatgaca gtgcaacggg ttctgtaaca aaaatcgtac ctatgacggc atcgggccat    1080
ggtgtgtggg aagcaacggt taatcaaaac cttgaaaatt ggtattacat gtatgaggta    1140
acaggccaag gctctacccg aacggctgtt gatccttatg caactgcgat tgcaccaaat    1200
ggaacgagag gcatgattgt ggacctggct aaaacagatc ctgctggctg gaacagtgat    1260
aaacatatta cgccaaagaa tatagaagat gaggtcatct atgaaatgga tgtccgtgac    1320
ttttccattg accctaattc gggtatgaaa aataaaggga gtatttggc tcttacagaa     1380
aaaggaacaa agggccctga caacgtaaag acggggatag attccttaaa acaacttggg    1440
attactcatg ttcagcttat gcctgttttc gcatctaaca gtgtcgatga aactgatcca    1500
acccaagata attggggtta tgaccctcgc aactatgatg ttcctgaagg gcagtatgct    1560
acaaatgcga atggtaatgc tcgtataaaa gagtttaagg aaatggttct ttcactccat    1620
cgtgaacaca ttggggttaa catggatgtt gtctataatc ataccttgc cacgcaaatc      1680
tctgacttcg ataaaattgt accagaatat tattaccgta cgatgatcca ggtaattata    1740
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ccaacggatc aggtactgga aatgaaattg cangcngaaa ggccaatggt tcaaaaattt   1800
attattgatt cccttaagta ttgggtcaat gagtatcata ttgacggctt ccgttttgac   1860
ttaatggcgc tgcttggaaa agacacgatg tccaaagctg cctcggagct tcatgctatt   1920
aatccaggaa ttgcacttta cggtgagcca tggacgggtg gaacctctgc actgccagat   1980
gatcagcttc tgacaaaagg agctcaaaaa ggcatgggag tagcggtgtt taatgacaat   2040
ttacgaaacg cgttggacgg caatgtcttt gattcttccg ctcaaggttt tgcgacaggt   2100
gcaacaggct taactgatgc aattaagaat ggcgttgagg ggagtattaa tgactttacc   2160
tcttcaccag gtgagacaat taactatgtc acaagtcatg ataactacac cctttgggac   2220
aaaatagccc taagcaatcc taatgattcc gaagcggatc ggattaaaat ggatgaactc   2280
gcacaagcag ttgttatgac ctcacaaggc gttccattca tgcaaggcgg ggaagaaatg   2340
cttcgtanaa aaggcggcaa cgacaatagt tataatgcag cgatgcggt caatgagttt   2400
gattggagca ggaaagctca atatccagat gttttcaact attatagcgg gctaatccac   2460
cttcgtcttg atcacccagc cttccgcatg acgacagcta atgaaatcaa tagccacctc   2520
caattcctaa atagtccaga gaacacagtg gcctatgaat taactgatca tgttaataaa   2580
gacaaatggg gaaatatcat tgttgtttat aacccaaata aaactgtagc aaccatcaat   2640
ttgccgagcg ggaaatgggc aatcaatgct acgagcggta aggtaggaga atccaccctt   2700
ggtcaagcag agggaagtgt ccaagtacca ggtatatcta tgatgatcct tcatcaagag   2760
gtaagcccag accacggtaa aaagtaatag aaaa                                2794
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<210> 2
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<212> PRT
<213> Bacillus deramificans

<220>
<221> VARIANT
<222> (1)...(956)
<223> Xaa = Any Amino Acid

<400> 2

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            20                  25                  30
Thr Thr Thr Ile Ile Val His Tyr Phe Cys Pro Ala Gly Asp Tyr Gln
        35                  40                  45
Pro Trp Ser Leu Trp Met Trp Pro Lys Asp Gly Gly Gly Ala Glu Tyr
    50                  55                  60
Asp Phe Asn Gln Pro Ala Asp Ser Phe Gly Ala Val Ala Ser Ala Asp
65                  70                  75                  80
Ile Pro Gly Asn Pro Ser Gln Val Gly Ile Ile Val Arg Thr Gln Asp
                85                  90                  95
Trp Thr Lys Asp Val Ser Ala Asp Arg Tyr Ile Asp Leu Ser Lys Gly
            100                 105                 110
Asn Glu Val Trp Leu Val Glu Gly Asn Ser Gln Ile Phe Tyr Asn Glu
        115                 120                 125
Lys Asp Ala Glu Asp Ala Ala Lys Pro Ala Val Ser Asn Ala Tyr Leu
    130                 135                 140
Asp Ala Ser Asn Gln Val Leu Val Lys Leu Ser Gln Pro Leu Thr Leu
145                 150                 155                 160
Gly Glu Gly Xaa Ser Gly Phe Thr Val His Asp Asp Thr Ala Asn Lys
                165                 170                 175
Asp Ile Pro Val Thr Ser Val Lys Asp Ala Ser Leu Gly Gln Asp Val
            180                 185                 190
Thr Ala Val Leu Ala Gly Thr Phe Gln His Ile Phe Gly Gly Ser Asp
        195                 200                 205
Trp Ala Pro Asp Asn His Ser Thr Leu Leu Lys Lys Val Thr Asn Asn
```

2

```
            210                  215                  220
Leu Tyr Gln Phe Ser Gly Asp Leu Pro Glu Gly Asn Tyr Gln Tyr Lys
225                  230                  235                  240
Val Ala Leu Asn Asp Ser Trp Asn Asn Ser Tyr Pro Ser Asp Asn Ile
                245                  250                  255
Asn Leu Thr Val Pro Ala Gly Gly Ala His Val Thr Phe Ser Tyr Ile
                260                  265                  270
Pro Ser Thr His Ala Val Tyr Asp Thr Ile Asn Asn Pro Asn Ala Asp
                275                  280                  285
Leu Gln Val Glu Ser Gly Val Lys Thr Asp Leu Val Thr Val Thr Leu
            290                  295                  300
Gly Glu Asp Pro Asp Val Ser His Thr Leu Ser Ile Gln Thr Asp Gly
305                  310                  315                  320
Tyr Gln Ala Lys Gln Val Ile Pro Arg Asn Val Leu Asn Ser Ser Gln
                325                  330                  335
Tyr Tyr Tyr Ser Gly Asp Asp Leu Gly Asn Thr Tyr Thr Gln Lys Ala
                340                  345                  350
Thr Thr Phe Lys Val Trp Ala Pro Thr Ser Thr Gln Val Asn Val Leu
                355                  360                  365
Leu Tyr Asp Ser Ala Thr Gly Ser Val Thr Lys Ile Val Pro Met Thr
                370                  375                  380
Ala Ser Gly His Gly Val Trp Glu Ala Thr Val Asn Gln Asn Leu Glu
385                  390                  395                  400
Asn Trp Tyr Tyr Met Tyr Glu Val Thr Gly Gln Gly Ser Thr Arg Thr
                405                  410                  415
Ala Val Asp Pro Tyr Ala Thr Ala Ile Ala Pro Asn Gly Thr Arg Gly
                420                  425                  430
Met Ile Val Asp Leu Ala Lys Thr Asp Pro Ala Gly Trp Asn Ser Asp
                435                  440                  445
Lys His Ile Thr Pro Lys Asn Ile Glu Asp Glu Val Ile Tyr Glu Met
                450                  455                  460
Asp Val Arg Asp Phe Ser Ile Asp Pro Asn Ser Gly Met Lys Asn Lys
465                  470                  475                  480
Gly Lys Tyr Leu Ala Leu Thr Glu Lys Gly Thr Lys Gly Pro Asp Asn
                485                  490                  495
Val Lys Thr Gly Ile Asp Ser Leu Lys Gln Leu Gly Ile Thr His Val
                500                  505                  510
Gln Leu Met Pro Val Phe Ala Ser Asn Ser Val Asp Glu Thr Asp Pro
            515                  520                  525
Thr Gln Asp Asn Trp Gly Tyr Asp Pro Arg Asn Tyr Asp Val Pro Glu
            530                  535                  540
Gly Gln Tyr Ala Thr Asn Ala Asn Gly Asn Ala Arg Ile Lys Glu Phe
545                  550                  555                  560
Lys Glu Met Val Leu Ser Leu His Arg Glu His Ile Gly Val Asn Met
                565                  570                  575
Asp Val Val Tyr Asn His Thr Phe Ala Thr Gln Ile Ser Asp Phe Asp
                580                  585                  590
Lys Ile Val Pro Glu Tyr Tyr Tyr Arg Thr Met Ile Gln Val Ile Ile
                595                  600                  605
Pro Thr Asp Gln Val Leu Glu Met Lys Leu Xaa Ala Glu Arg Pro Met
                610                  615                  620
Val Gln Lys Phe Ile Ile Asp Ser Leu Lys Tyr Trp Val Asn Glu Tyr
625                  630                  635                  640
His Ile Asp Gly Phe Arg Phe Asp Leu Met Ala Leu Leu Gly Lys Asp
                645                  650                  655
Thr Met Ser Lys Ala Ala Ser Glu Leu His Ala Ile Asn Pro Gly Ile
                660                  665                  670
```

3

```
Ala Leu Tyr Gly Glu Pro Trp Thr Gly Gly Thr Ser Ala Leu Pro Asp
        675                 680                 685
Asp Gln Leu Leu Thr Lys Gly Ala Gln Lys Gly Met Gly Val Ala Val
        690                 695                 700
Phe Asn Asp Asn Leu Arg Asn Ala Leu Asp Gly Asn Val Phe Asp Ser
705                 710                 715                 720
Ser Ala Gln Gly Phe Ala Thr Gly Ala Thr Gly Leu Thr Asp Ala Ile
            725                 730                 735
Lys Asn Gly Val Glu Gly Ser Ile Asn Asp Phe Thr Ser Ser Pro Gly
            740                 745                 750
Glu Thr Ile Asn Tyr Val Thr Ser His Asp Asn Tyr Thr Leu Trp Asp
        755                 760                 765
Lys Ile Ala Leu Ser Asn Pro Asn Asp Ser Glu Ala Asp Arg Ile Lys
        770                 775                 780
Met Asp Glu Leu Ala Gln Ala Val Val Met Thr Ser Gln Gly Val Pro
785                 790                 795                 800
Phe Met Gln Gly Gly Glu Glu Met Leu Arg Xaa Lys Gly Gly Asn Asp
            805                 810                 815
Asn Ser Tyr Asn Ala Gly Asp Ala Val Asn Glu Phe Asp Trp Ser Arg
        820                 825                 830
Lys Ala Gln Tyr Pro Asp Val Phe Asn Tyr Tyr Ser Gly Leu Ile His
        835                 840                 845
Leu Arg Leu Asp His Pro Ala Phe Arg Met Thr Thr Ala Asn Glu Ile
        850                 855                 860
Asn Ser His Leu Gln Phe Leu Asn Ser Pro Glu Asn Thr Val Ala Tyr
865                 870                 875                 880
Glu Leu Thr Asp His Val Asn Lys Asp Lys Trp Gly Asn Ile Ile Val
            885                 890                 895
Val Tyr Asn Pro Asn Lys Thr Val Ala Thr Ile Asn Leu Pro Ser Gly
            900                 905                 910
Lys Trp Ala Ile Asn Ala Thr Ser Gly Lys Val Gly Glu Ser Thr Leu
        915                 920                 925
Gly Gln Ala Glu Gly Ser Val Gln Val Pro Gly Ile Ser Met Met Ile
        930                 935                 940
Leu His Gln Glu Val Ser Pro Asp His Gly Lys Lys
945                 950                 955

        <210> 3
        <211> 718
        <212> PRT
        <213> Bacillus subtilis

        <400> 3
Met Val Ser Ile Arg Arg Ser Phe Glu Ala Tyr Val Asp Asp Met Asn
1                   5                   10                  15
Ile Ile Thr Val Leu Ile Pro Ala Glu Gln Lys Glu Ile Met Thr Pro
            20                  25                  30
Pro Phe Arg Leu Glu Thr Glu Ile Thr Asp Phe Pro Leu Ala Val Arg
        35                  40                  45
Glu Glu Tyr Ser Leu Glu Ala Lys Tyr Lys Tyr Val Cys Val Ser Asp
        50                  55                  60
His Pro Val Thr Phe Gly Lys Ile His Cys Val Arg Ala Ser Ser Gly
65                  70                  75                  80
His Lys Thr Asp Leu Gln Ile Gly Ala Val Ile Arg Thr Ala Ala Phe
                85                  90                  95
Asp Asp Glu Phe Tyr Tyr Asp Gly Glu Leu Gly Ala Val Tyr Thr Ala
            100                 105                 110
```

4

```
Asp His Thr Val Phe Lys Val Trp Ala Pro Ala Ala Thr Ser Ala Ala
        115             120             125
Val Lys Leu Ser His Pro Asn Lys Ser Gly Arg Thr Phe Gln Met Thr
        130             135             140
Arg Leu Glu Lys Gly Val Tyr Ala Val Thr Val Thr Gly Asp Leu His
145             150             155             160
Gly Tyr Glu Tyr Leu Phe Cys Ile Cys Asn Asn Ser Glu Trp Met Glu
                165             170             175
Thr Val Asp Gln Tyr Ala Lys Ala Val Thr Val Asn Gly Glu Lys Gly
            180             185             190
Val Val Leu Arg Pro Asp Gln Met Lys Trp Thr Ala Pro Leu Lys Pro
        195 ·             200             205
Phe Ser His Pro Val Asp Ala Val Ile Tyr Glu Thr His Leu Arg Asp
    210             215             220
Phe Ser Ile His Glu Asn Ser Gly Met Ile Asn Lys Gly Lys Tyr Leu
225             230             235             240
Ala Leu Thr Glu Thr Asp Thr Gln Thr Ala Asn Gly Ser Ser Ser Gly
            245             250             255
Leu Ala Tyr Val Lys Glu Leu Gly Val Thr His Val Glu Leu Leu Pro
        260             265             270
Val Asn Asp Phe Ala Gly Val Asp Glu Glu Lys Pro Leu Asp Ala Tyr
        275             280             285
Asn Trp Gly Tyr Asn Pro Leu His Phe Phe Ala Pro Glu Gly Ser Tyr
    290             295             300
Ala Ser Asn Pro His Asp Pro Gln Thr Arg Lys Thr Glu Leu Lys Gln
305             310             315             320
Met Ile Asn Thr Leu His Gln His Gly Leu Arg Val Ile Leu Asp Val
            325             330             335
Val Phe Asn His Val Tyr Lys Arg Glu Asn Ser Pro Phe Glu Lys Thr
        340             345             350
Val Pro Gly Tyr Phe Phe Arg His Asp Glu Cys Gly Met Pro Ser Asn
        355             360             365
Gly Thr Gly Val Gly Asn Asp Ile Ala Ser Glu Arg Arg Met Ala Arg
    370             375             380
Lys Phe Ile Ala Asp Cys Val Val Tyr Trp Leu Glu Glu Tyr Asn Val
385             390             395             400
Asp Gly Phe Arg Phe Asp Leu Leu Gly Ile Leu Asp Ile Asp Thr Val
            405             410             415
Leu Tyr Met Lys Glu Lys Ala Thr Lys Ala Lys Pro Gly Ile Leu Leu
            420             425             430
Phe Gly Glu Gly Trp Asp Leu Ala Thr Pro Leu Pro His Glu Gln Lys
        435             440             445
Ala Ala Leu Ala Asn Ala Pro Arg Met Pro Gly Ile Gly Phe Phe Asn
    450             455             460
Asp Met Phe Arg Asp Ala Val Lys Gly Asn Thr Phe His Leu Lys Ala
465             470             475             480
Thr Gly Phe Ala Leu Gly Asn Gly Glu Ser Ala Gln Ala Val Met His
            485             490             495
Gly Ile Ala Gly Ser Ser Gly Trp Lys Ala Leu Ala Pro Ile Val Pro
            500             505             510
Glu Pro Ser Gln Ser Ile Asn Tyr Val Glu Ser His Asp Asn His Thr
        515             520             525
Phe Trp Asp Lys Met Ser Phe Ala Leu Pro Gln Glu Asn Asp Ser Arg
    530             535             540
Lys Arg Ser Arg Gln Arg Leu Ala Val Ala Ile Ile Leu Leu Ala Gln
545             550             555             560
Gly Val Pro Phe Ile His Ser Gly Gln Glu Phe Phe Arg Thr Lys Gln
```

5

```
                        565                      570                      575
Gly Val Glu Asn Ser Tyr Gln Ser Ser Asp Ser Ile Asn Gln Leu Asp
                    580                      585                      590
Trp Asp Arg Arg Glu Thr Phe Lys Glu Asp Val His Tyr Ile Arg Arg
                595                      600                      605
Leu Ile Ser Leu Arg Lys Ala His Pro Ala Phe Arg Leu Arg Ser Ala
        610                      615                      620
Ala Asp Ile Gln Arg His Leu Glu Cys Leu Thr Leu Lys Glu His Leu
625                      630                      635                      640
Ile Ala Tyr Arg Leu Tyr Asp Leu Asp Glu Val Asp Glu Trp Lys Asp
                645                      650                      655
Ile Ile Val Ile His His Ala Ser Pro Asp Ser Val Glu Trp Arg Leu
                660                      665                      670
Pro Asn Asp Ile Pro Tyr Arg Leu Leu Cys Asp Pro Ser Gly Phe Gln
            675                      680                      685
Glu Asp Pro Thr Glu Ile Lys Lys Thr Val Ala Val Asn Gly Ile Gly
        690                      695                      700
Thr Val Ile Leu Tyr Leu Ala Ser Asp Leu Lys Ser Phe Ala
705                      710                      715


        <210> 4
        <211> 1091
        <212> PRT
        <213> Klebsiella pneumonia


        <400> 4
Met Leu Arg Tyr Thr Arg Asn Ala Leu Val Leu Gly Ser Leu Val Leu
  1               5                      10                      15
Leu Ser Gly Cys Asp Asn Gly Ser Ser Ser Ser Ser Ser Ser Gly Asn
                20                      25                      30
Pro Asp Thr Pro Asp Asn Gln Asp Val Val Val Arg Leu Pro Asp Val
            35                      40                      45
Ala Val Pro Gly Glu Ala Val Thr Ala Val Glu Asn Gln Ala Val Ile
        50                      55                      60
His Leu Val Asp Ile Ala Gly Ile Thr Ser Ser Ser Ala Ala Asp Tyr
65                      70                      75                      80
Ser Ser Lys Asn Leu Tyr Leu Trp Asn Asn Glu Thr Cys Asp Ala Leu
                85                      90                      95
Ser Ala Pro Val Ala Asp Trp Asn Asp Val Ser Thr Thr Pro Ser Gly
                100                      105                      110
Ser Asp Lys Tyr Gly Pro Tyr Trp Val Ile Pro Leu Asn Lys Glu Ser
                115                      120                      125
Gly Cys Ile Asn Val Ile Val Arg Asp Gly Thr Asp Lys Leu Ile Asp
        130                      135                      140
Ser Asp Leu Arg Val Ala Phe Gly Asp Phe Thr Asp Arg Thr Val Ser
145                      150                      155                      160
Val Ile Ala Gly Asn Ser Ala Val Tyr Asp Ser Arg Ala Asp Ala Phe
                165                      170                      175
Arg Ala Ala Phe Gly Val Ala Leu Ala Glu Ala His Trp Val Asp Lys
                180                      185                      190
Asn Thr Leu Leu Trp Pro Gly Gly Gln Asp Lys Pro Ile Val Arg Leu
                195                      200                      205
Tyr Tyr Ser His Ser Ser Lys Val Ala Ala Asp Gly Glu Gly Lys Phe
        210                      215                      220
Thr Asp Arg Tyr Leu Lys Leu Thr Pro Thr Thr Val Ser Gln Gln Val
225                      230                      235                      240
Ser Met Arg Phe Pro His Leu Ser Ser Tyr Ala Ala Phe Lys Leu Pro
```

6

```
                    245                    250                    255
Asp Asn Ala Asn Val Asp Glu Leu Leu Gln Gly Glu Thr Val Ala Ile
            260                    265                    270
Ala Ala Ala Glu Asp Gly Ile Leu Ile Ser Ala Thr Gln Val Gln Thr
        275                    280                    285
Ala Gly Val Leu Asp Asp Ala Tyr Ala Glu Ala Ala Glu Ala Leu Ser
    290                    295                    300
Tyr Gly Ala Gln Leu Ala Asp Gly Gly Val Thr Phe Arg Val Trp Ala
305                    310                    315                    320
Pro Thr Ala Gln Gln Val Asp Val Val Val Tyr Ser Ala Asp Lys Lys
                325                    330                    335
Val Ile Gly Ser His Pro Met Thr Arg Asp Ser Ala Ser Gly Ala Trp
            340                    345                    350
Ser Trp Gln Gly Gly Ser Asp Leu Lys Gly Ala Phe Tyr Arg Tyr Ala
        355                    360                    365
Met Thr Val Tyr His Pro Gln Ser Arg Lys Val Glu Gln Tyr Glu Val
    370                    375                    380
Thr Asp Pro Tyr Ala His Ser Leu Ser Thr Asn Ser Glu Tyr Ser Gln
385                    390                    395                    400
Val Val Asp Leu Asn Asp Ser Ala Leu Lys Pro Asp Gly Trp Asp Asn
                405                    410                    415
Leu Thr Met Pro His Ala Gln Lys Thr Lys Ala Asp Leu Ala Lys Met
            420                    425                    430
Thr Ile His Glu Ser His Ile Arg Asp Leu Ser Ala Trp Asp Gln Thr
        435                    440                    445
Val Pro Ala Glu Leu Arg Gly Lys Tyr Leu Ala Leu Thr Ala Gly Asp
    450                    455                    460
Ser Asn Met Val Gln His Leu Lys Thr Leu Ser Ala Ser Gly Val Thr
465                    470                    475                    480
His Val Glu Leu Leu Pro Val Phe Asp Leu Ala Thr Val Asn Glu Phe
                485                    490                    495
Ser Asp Lys Val Ala Asp Ile Gln Gln Pro Phe Ser Arg Leu Cys Glu
            500                    505                    510
Val Asn Ser Ala Val Lys Ser Ser Glu Phe Ala Gly Tyr Cys Asp Ser
        515                    520                    525
Gly Ser Thr Val Glu Glu Val Leu Asn Gln Leu Lys Gln Ser Asp Ser
    530                    535                    540
Gln Asp Asn Pro Gln Val Gln Ala Leu Asn Thr Leu Val Ala Gln Thr
545                    550                    555                    560
Asp Ser Tyr Asn Trp Gly Tyr Asp Pro Phe His Tyr Thr Val Pro Glu
                565                    570                    575
Gly Ser Tyr Ala Thr Asp Pro Glu Gly Thr Thr Arg Ile Lys Glu Phe
            580                    585                    590
Arg Thr Met Ile Gln Ala Ile Lys Gln Asp Leu Gly Met Asn Val Ile
        595                    600                    605
Met Asp Val Val Tyr Asn His Thr Asn Ala Ala Gly Pro Thr Asp Arg
    610                    615                    620
Thr Ser Val Leu Asp Lys Ile Val Pro Trp Tyr Tyr Gln Arg Leu Asn
625                    630                    635                    640
Glu Thr Thr Gly Ser Val Glu Ser Ala Thr Cys Cys Ser Asp Ser Ala
                645                    650                    655
Pro Glu His Arg Met Phe Ala Lys Leu Ile Ala Asp Ser Leu Ala Val
            660                    665                    670
Trp Thr Thr Asp Tyr Lys Ile Asp Gly Phe Arg Phe Asp Leu Met Gly
        675                    680                    685
Tyr His Pro Lys Ala Gln Ile Leu Ser Ala Trp Glu Arg Ile Lys Ala
    690                    695                    700
```

7

```
Leu Asn Pro Asp Ile Tyr Phe Phe Gly Glu Gly Trp Asp Ser Asn Gln
705                 710                 715                 720
Ser Asp Arg Phe Glu Ile Ala Ser Gln Ile Asn Leu Lys Gly Thr Gly
                725                 730                 735
Ile Gly Thr Phe Ser Asp Arg Leu Arg Asp Ser Val Arg Gly Gly Gly
                740                 745                 750
Pro Phe Asp Ser Gly Asp Ala Leu Arg Gln Asn Gln Gly Ile Gly Ser
                755                 760                 765
Gly Ala Gly Val Leu Pro Asn Glu Leu Ala Ser Leu Ser Asp Asp Gln
    770                 775                 780
Val Arg His Leu Ala Asp Leu Thr Arg Leu Gly Met Ala Gly Asn Leu
785                 790                 795                 800
Ala Asp Phe Val Met Ile Asp Lys Asp Gly Ala Ala Lys Lys Gly Ser
                805                 810                 815
Glu Ile Asp Tyr Asn Gly Ala Pro Gly Gly Tyr Ala Ala Asp Pro Thr
                820                 825                 830
Glu Val Val Asn Tyr Val Ser Lys His Asp Asn Gln Thr Leu Trp Asp
                835                 840                 845
Met Ile Ser Tyr Lys Ala Ser Gln Glu Ala Asp Leu Ala Thr Arg Val
    850                 855                 860
Arg Met Gln Ala Val Ser Leu Ala Thr Val Met Leu Gly Gln Gly Ile
865                 870                 875                 880
Ala Phe Asp Gln Gln Gly Ser Glu Leu Leu Arg Ser Lys Ser Phe Thr
                885                 890                 895
Arg Asp Ser Tyr Asp Ser Gly Asp Trp Phe Asn Arg Val Asp Tyr Ser
                900                 905                 910
Leu Gln Asp Asn Asn Tyr Asn Val Gly Met Pro Arg Ile Ser Asp Asp
    915                 920                 925
Gly Ser Asn Tyr Glu Val Ile Thr Arg Val Lys Glu Met Val Ala Thr
    930                 935                 940
Pro Gly Glu Ala Glu Leu Lys Gln Met Thr Ala Phe Tyr Gln Glu Leu
945                 950                 955                 960
Thr Glu Leu Arg Lys Ser Ser Pro Leu Phe Thr Leu Gly Asp Gly Ser
                965                 970                 975
Ala Val Met Lys Arg Val Asp Phe Arg Asn Thr Gly Ser Asp Gln Gln
                980                 985                 990
Ala Gly Leu Leu Val Met Thr Val Asp Asp Gly Met Lys Ala Gly Ala
    995                 1000                1005
Ser Leu Asp Ser Arg Leu Asp Gly Leu Val Val Ala Ile Asn Ala Ala
    1010                1015                1020
Pro Glu Ser Arg Thr Leu Asn Glu Phe Ala Gly Glu Thr Leu Gln Leu
1025                1030                1035                1040
Ser Ala Ile Gln Gln Thr Ala Gly Glu Asn Ser Leu Ala Asn Gly Val
                1045                1050                1055
Gln Ile Ala Ala Asp Gly Thr Val Thr Leu Pro Ala Trp Ser Val Ala
                1060                1065                1070
Val Leu Glu Leu Pro Gln Gly Glu Ala Gln Gly Ala Gly Leu Pro Val
    1075                1080                1085
Ser Ser Lys
    1090

    <210> 5
    <211> 6
    <212> PRT
    <213> Artificial Sequence

    <220>
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8

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<223> Unknown

<400> 5
Asp Val Val Ile Asn His
1               5


<210> 6
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Unknown

<400> 6
Gly Phe Arg Leu Asp Ala Ala Lys His
1               5


<210> 7
<211> 6
<212> PRT
<213> Artificial Sequence

<220>
<223> Unknown

<400> 7
Phe Val Asp Val His Asp
1               5


<210> 8
<211> 5
<212> PRT
<213> Artificial Sequence

<220>
<223> Unknown

<400> 8
Tyr Asn Trp Gly Tyr
1               5


<210> 9
<211> 4
<212> PRT
<213> Artificial Sequence

<220>
<223> Unknown

<400> 9
Val Trp Ala Pro
1
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